ARCH/ENST 322 and 622

Spring 2015

Case Studies in Sustainability: The High Performance Building on The Rice Campus

"The Regenerative Repositioning

of the Rice Campus and its Buildings"

Rives Taylor (assisted by Richard Johnson and guests)

A) Intent

The intent is to provide a means by which all those with an interest in the performance of commercial, institutional, and residential structures and the related building science can investigate common issues, obtain information, discuss local issues, and otherwise address subjects relating to the building enclosure.

The seminar class will create an interdisciplinary forum where students of architecture, engineering (structural, mechanical, etc.), and human sciences meet with professional consultants, manufacturers, contractors, developers, owners, and Rice campus facility managers.

The task forces will be approximately 4 to 6 team members. Each team will select a project manager and will work together with professors Taylor and Johnson on scoping the semester

Teams will develop assessment tools to understand approach precedents, utilize workplace surveys/data about the sustainable and healthful learning/work environment, and the demographic shift of the expectations of "next-gen" facility inhabitants.

The focus can range from Rice interiors recasting, building performance, stormwater detention tactics to ways that the inner loop might change if it were to be anchor of a bike/pedestrian network if Rice implements an outer-loop vehicle concept.

B) Mission

1. Discover information about local issues and cases, relevant weather conditions, and all matters concerning the Rice University building or campus component performance
   - Technology such as interior designs, systems and enclosure and

the related science;
- Human factors of education, habit use, behavior, and feedback loops;

2. Initiate and promote cross-disciplinary and cross-responsibility dialogue;

3. Investigate process, and understand codes, regulations, standards, liability matters, and the like for matters that affect the building enclosure;
4. To develop a sound technical and economic foundation for optimum energy efficiency in the design, construction, operation, and modification of new and existing buildings through the coordination of research, development, and verification programs;
5. To expedite the use of existing and new technologies in building practice through improved coordination of the activities of the various components of the building community;
6. To explore the human factors include well-being, delight and curiosity in the physical environment;
and
7. To integrate technical programs on fire safety and thermal comfort with the thermal performance of building interiors, systems and envelopes.

C) "Rough" class schedule
(referring to Arch/Enst 322 and 622 SYLLABUS Spring 2015, at end of document, Appendix A)
To be developed with Rice student teams (of 5 or so) and facility leadership:

Weeks 1 to 4:
-High performance facility or campus component defined
-For architecture, Core + Shell and Interiors components defined;
-For planning or operations, appropriate tactics for delivery;
-Teams Select Rice Campus project;
-Seek team resources, internal leadership and any consultants
-Research and design problem statement.

Weeks 5 to 10
-Project investigation/delivery;
-Classes as resource sessions, coordinated team meetings.

Weeks 8 to 11
-Presentation preparation
-Classes as resource sessions

Weeks 11 and 12
- Present to Rice Campus Client

D) Specific course requirements are as follows:
THIS COURSE FOCUSES ON TEAM DELIVERY TO ADDRESS Target Facilities or Campus Strategies suggested by Rice facilities leadership (Richard Johnson): the preliminary list is in Appendix 3

- Class participation: **all students are required to attend class regularly,** sign in, and contribute to class discussions that critically evaluate readings and case studies.

  Grading 10%.

- Project 1: CASE STUDY

  Students will select a case study review within their area of interest and draft a final paper/plan/site plan/architectural design based on specific parameters (see discussion below). All students' final work will be submitted as a digital document or hardcopy following Rice standards on the due date noted in the schedule.
  313 Students: Students may work individually or in groups no larger than 5 team members.

  Grading 30%.

- Project 2: Rice campus Building Recladding/reposition research

  Students will be required to select an eco-footprint of a common material based on specific parameters noted below.
  313 Students: Students may work individually or in groups no larger than 5 team members.

  Grading 60%.

E) Semester Work Detailed

Assignment 1 (Project 1)
Sustainable Case Study

3000 to 4000 words

To support the main semester project, I would like each student to investigate sustainable architectural and planning projects in and out of Houston and see what might be applied here with our climate and applicable to the main semester project. At a minimum I am interested in

- Precedent—Gathering information from architectural history and building on what Walter Gropius called "the collected wisdom of architecture."
    - Technical—prototypical solutions to the critical technical issues of the design problem.
    - Architectural—appropriate examples that match the design parameters and intentions.
    - Historical—contextual or otherwise appropriate adaptations of formal elements.
- Functional requirements—areas and adjacencies, special equipment and other elements of the client brief.
- Code—any limits to sustainable thinking – for example Houston City Code is uncomfortable with waterless urinals![i]
- Climate—design data and normal data.
- Cost—historical trends and recent experiences.[ii]
- Demographics—regional and neighborhood impacts of population and infrastructure such as transportation, services and amenities.
- Timeframe/scheduling—construction, phased expansion, flexibility, obsolescence.
- Performance/maintenance assumptions—life cycle considerations.
- Systems thinking—problem, environment, resources, management, product. Deep inter-relatedness, complexity, and holistic solutions.

Add to this outline sustainable approaches:

- What were the sustainable targets, strategies, and technologies?
- Materials types and sources – how used for a durable and maintainable situation?
- Are any applicable to Houston's climate?
- Actual design response (plans, drawings, papers)
- Where in the process is the project (is it finished? How long the delivery process?)
- Was the project successful – performance metrics, and what have the users thought?

See Appendix B at end of this document for dossier format as well as other points of coverage. **You must complete a form like this for your case study as well as the remainder of the report.**

Grading for Case Study

Grade of 95%
Full description case study data, narrative, outcomes when project realized and how it performed, with copious illustrations, including team commentary on missing pieces of the puzzle. Rudimentary full cost and operations implications. Full bibliography and MULTIPLE and VALIDATING sources, including team commentary on validity of these sources.

Grade of 85%:
Good description of project with illustrations and sources, but minimal team commentary on design targets and realized outcomes, and/or costing.

Grade of 75%
A minimal submission, with uncertainties in case study outcomes

Assignment 2 (Project 2)

Team Proposed Research Topic is purposefully organized to allow a breadth of student RESEARCH and presentation. Part of the semester "Grading" will be based upon the nature of research and ability to communicate findings based on substantial investigation, as well as quality of final delivery.

Minimal requirements for this research are

- Midterm précis, proposal of method and bibliography (lessons learned from case study
- Final product – size and method of presentation to be negotiated with professor

Grade of 95%

Full description of proposed facility or campus component optimization data, narrative, outcomes when project realized and how it will deliver best outcomes from a variety of (discipline) perspectives, with copious illustrations, including team commentary on missing pieces of the puzzle. Rudimentary full cost and operations implications. Full bibliography and MULTIPLE and VALIDATING sources, including team commentary on validity of these sources.

Grade of 85%:
Good description of project with illustrations and sources, but minimal team commentary on design targets and realized outcomes, and/or costing.

Grade of 75%
A minimal submission, with uncertainties in case study outcomes

F) Semester Work Detailed

The target for the work submitted to be delivered to Prof. Taylor:

Project 1: Case Study/Precedent: first Draft March 13, 2015
Project 2: Rice Intervention first Draft. April 10, 2015

All final work:

Graduating Students: All Semester Papers final deadline for all students: 5:00 PM 5th May.

NON Graduating Students: All Semester Papers final deadline for all students: 5:00 PM 17th May.

Appendix A – Schedule Detail

Mapping the Semester

class 1

January 15, 2015

Nature of Teams

The High Performance Building and its Envelope as Focus

The Houston and Rice lens, and the State of Sustainability in light of the culture of Architecture

Challenge: Architecture 2030

Value of Ecosystem - Natural Capitalism

Notion of "repositioning"

class 2

January 22, 2015

Project Teams Identified

MEASUREMENTS FOR PERFORMANCE

1) Ecological Footprint and Embodied Energy

2) Energy Modeling + Other Performance Metrics

3) Accounting/Total Life Cycle + Full Cost

4) Leadership in Energy and Environmental Design

class 3

January 29, 2015

RICE CONTEXT and GLOBAL BENCHMARKS

class 4

February 5, 2015

Project: problem statement

MAPPING THE PROCESS

Technical, Cultural, Human and Natural Dimensions as the Sustainable Design Context

General Resources for Repositioning Investigation

class 5

February 12, 2015

Team worksession 2nd half of class

Site, Ecosystem, Water + Case Study

1) utility, natural systems, orientation and climatology, biodiversity, vegetated surfaces

2) potable, non potable, grey and black, harvesting

class 6 **February 19, 2015** *Team worksession* *2nd half of class*	**Energy & Atmosphere + Case Study** Commissioning, Modeling, Energy Optimization, Renewable Energy, Green Energy, Carbon Offsets and/or Sequestration
class 7 **February 26, 2015**	Midterm Project Reviews
DATE	**CONCEPT FOCI**
March 5, 2015	Springbreak
class 8 **March 12, 2015** Project: Draft Precedent	**Presentation Methodology**
class 9 **March 19, 2015** *Team Presentations* *Methods review*	**Indoor Environmental Quality + Case Study** Human environment - workplace, living, educating… social sustainability
class 10 **March 26, 2015**	**Material Resources + Case Study** Life cycle footprint, sourcing, tectonics, design for disassembly, self replicating, biomimic
April 2, 2015	midterm break
class 11	

April 9, 2015	**Reviews and Assist**
Project: Draft Intervention	
class 12	
April 16, 2015	**Team Group 1 Presentation**
class 13	
April 23, 2015	**Team Group 2 Presentation**

Appendix B

Example of Basic Data Set or Project Dossier for Case Study (Project Part 1)

EXAMPLE

The Gregory Bateson Building, Sacramento, California

Sim Van der Ryn, State Architect

Table 11.1 Fact Sheet

Project	Building name	The Gregory Bateson Building, GBB
	Client	State of California, Department of General Services, Governor Jerry Brown
	City	Sacramento
	State	California
	Country	USA
	Lat/Long/Elev	38.58N 121.50W. Height 7-m or 22-ft above sea level.
Team	Architect	Sim van der Ryn, State Architect and the CA Energy Efficient State Building Program
	Other Team Members	Peter Calthorpe, Bruce Corson, Scott Mathews, Glenn Hezmalhalch, Jim Barnett, Ed Street
	Structural Engineer	Karl Stricker
	Mechanical Engineer	Vern Thornburg and Russ Ahrnsbrak
	Civil Engineer	Ben Shook
	Electrical Engineer	Doug Yee and Angleo Spataro
	Construction	Continental Heller Corp.
General	Timeline	1977- March 1981
	Floor Area	267,000 ft² gross, not including the enclosed atrium
	Occupancy	Government offices, mostly in health care area, about 1200 office workers or 22 occupants per 1000 ft².
	Cost	$20 million (1978 dollars), $62/ft²
	Cost in 1995 $US	46.7 million or $175/ft².

Site	Site Description	GBB occupies a full 2.5-acre block in downtown Sacramento's Capital Area. This district was undergoing revitalization as a mixed use, low rise, and urban village scale pattern of development.
	Parking, Cars	None
Structure	Stories	Four
	Plan	Rectangular plan with central atrium.
	Foundation	Not determined
	Vertical Members	Precast concrete ladder frame on concrete piers
	Horizontal Spans	Cast in place concrete beams with precast concrete double tee spans and concrete topping
Envelope	Glass and Glazing	Automated window shading with translucent rolling fabric
	Skylights	Skylit atrium of 150 feet by 144 feet with 75 foot height.
	Cladding	Laminated wood timber infill and aluminum framed glass, R-19 cavity insulation
	Roof	R-19 insulation
HVAC	Equipment	Central plant steam and chilled water
	Cooling Type	Two supplementary 660-ton rock beds are located below the atrium floor and insulated with R-19 expanded polystyrene.
	Distribution	VAV
	Duct Type	Exposed metal
	Vertical Chases	Flanking the atrium
Interior	Partitions	Glazed to atrium
	Finishes	Acoustical baffles in exposed concrete ceilings
	Vertical Circulation	Atrium stairs wrapped around elevator shafts
	Furniture	Open office
	Lighting	Fluorescent and task lighting

[i] See Allen and Iano, The Architect's Studio Companion.
[ii] See www.rsmeans.com/ for a free online resource with system cost data breakdowns and case studies.

Mapping the Semester

class 1 **January 15, 2015** *Nature of Teams*	**The High Performance Building and its Envelope as Focus** The Houston and Rice lens, and the State of Sustainability in light of the culture of Architecture Challenge: Architecture 2030 Value of Ecosystem - Natural Capitalism Notion of "repositioning"
class 2 **January 22, 2015** Project Teams Identified	**MEASUREMENTS FOR PERFORMANCE** 1) Ecological Footprint and Embodied Energy 2) Energy Modeling + Other Performance Metrics 3) Accounting/Total Life Cycle + Full Cost 4) Leadership in Energy and Environmental Design
class 3 **January 29, 2015**	**RICE CONTEXT and GLOBAL BENCHMARKS**
class 4 **February 5, 2015** Project: problem statement	**MAPPING THE PROCESS** Technical, Cultural, Human and Natural Dimensions as the Sustainable Design Context

General Resources for Repositioning Investigation

class 5 **February 12, 2015** Team worksession 2nd half of class	**Site, Ecosystem, Water + Case Study** 1) utility, natural systems, orientation and climatology, biodiversity, vegetated surfaces 2) potable, non potable, grey and black, harvesting
class 6	**Energy & Atmosphere + Case Study**

February 19, 2015 *Team worksession* *2nd half of class*	Commissioning, Modeling, Energy Optimization, Renewable Energy, Green Energy, Carbon Offsets and/or Sequestration
class 7 **February 26, 2015**	Midterm Project Reviews
DATE	**CONCEPT FOCI**
March 5, 2015	Springbreak
class 8 **March 12, 2015** Project: Draft Precedent	**Presentation Methodology**
class 9 **March 19, 2015** *Team Presentations* *Methods review*	**Indoor Environmental Quality + Case Study** Human environment - workplace, living, educating… social sustainability
class 10 **March 26, 2015**	**Material Resources + Case Study** Life cycle footprint, sourcing, tectonics, design for disassembly, self replicating, biomimic
April 2, 2015	midterm break
class 11	

April 9, 2015	**Reviews and Assist**
Project: Draft Intervention	
class 12	
April 16, 2015	**Team Group 1 Presentation**
class 13	
April 23, 2015	**Team Group 2 Presentation**

Appendix 3

Potential Projects:

1. **The Barren Plaza.** When the South Servery was constructed to serve Hanszen College and the relocated Wiess College in 2002, its design included an extensive outdoor plaza accessible from the second floor as well as from a grand stairway from the west side of the building. This plaza, intended to be a busy hub of student activities, has instead proven to be a barren, underused space. Why? The student team will take a critical look at the design of the plaza, and through observation and interviews, will identify the factors that keep this space from being successful. Next, the students will review how designers in other locations have breathed new life into similarly forgotten plazas and public spaces. From this, the team will develop a new vision – or set of alternative visions – for this space, which will be shared with the leadership of Housing and Dining (who oversee the space).

2. **A "Complete Street" at Rice's Western Edge.** Advocates of "smart growth" promote the concept of "complete streets" as an approach to improve neighborhoods, bolster economic growth, provide safer mobility across a variety of modes (pedestrians, bicyclists, cars, etc.), and create a more livable city. The student team will research the Complete Streets movement, including efforts and examples in Houston and elsewhere in Texas. How might this concept be applied to Greenbriar Street between Rice Boulevard and University? What is the importance of this edge to the Rice campus and to the community? What modifications would the team suggest to the street itself and the development on either side of the street in order to achieve this new vision?

3. **Sweaters in Summer?** In 2006, a student team from this class created a thermal comfort survey for building occupants, and the findings indicated that most felt that Rice buildings were over-air conditioned. The results of this survey ultimately led to the adoption of Rice's building temperature policy in early 2009. So how are we doing six years later? The student team will construct a thermal comfort survey that meets the requirements of the USGBC's LEED 2009 credit IEQ 7.2 Thermal Comfort – Verification, and will administer the survey to occupants in several non-lab buildings in a manner that meets the credits requirements. The team will then review the responses, identify and report problem areas, and draw broader conclusions about Rice's performance in providing an appropriate and energy-efficient thermal range for indoor environments, and make recommendations for the future.

4. **Re-imagining the Rice Workplace.** The office spaces of Rice University often reflect the work habits and expectations of the generation currently in leadership positions (i.e. the Baby Boomers), and even potentially generations prior to that. However, younger generations – especially the Millennial Generation – were raised with digital technologies, work in very different ways than the Baby Boomers, and have different expectations of the workplace. How do the work habits and spatial/environmental expectations of workers under the age of 30 differ from older generations, and what implications might this have for the design of Rice workspaces and interiors? In what ways are these habits and expectations consistent with "green" strategies, and in what ways are they in conflict? This project should include a review of existing studies as well as direct interviews with younger Rice employees to gain campus-appropriate insights.

5. **Just Print It**! In March 2013, Harvard Business Review proclaimed that "3-D Printing Will Change the World" and international business consultant McKinsey & Company identified 3-D printing as one of twelve technologies "that will transform life, business, and the global economy." How will 3-D printing change the design, construction, and maintenance of buildings? The project team will scan the literature of the present and future of 3-D printing, identifying examples and predictions within the architecture and facilities maintenance arenas, and will develop a cohesive narrative with an estimated timeline to help educate and prepare Rice's facilities team about how 3-D printing might be used for building design, construction, and maintenance at Rice.

6. **The Tiny Dorm?** While the term McMansion is synonymous with the ever-larger new homes constructed during the 90s and 00s and beyond, a countermovement that appears to be growing in interest is the "tiny house" or "small house" movement, where people live with comparatively fewer possessions in significantly smaller homes. Are Rice's more recent residential college buildings (Martel, Duncan, McMurtry, and the new wings of Baker and Will Rice) the dormitory equivalent of McMansions? How much space do students really need? What items form the core of what needs to be within a student room? Is there a place for smaller "tiny" rooms within the residential college system? How much smaller would these rooms be? How many more rooms could one add to a residential college if a portion were renovated using a "tiny" concept? How interested would Rice students be in these rooms? Would decreased housing fees for tiny rooms influence attitudes? The project team will explore these and other questions as they consider whether the "Tiny House" movement has a place on the Rice

campus.

7. **A Better Connection.** Rice sits alongside three light rail stations: Hermann Park / Rice University, Memorial Hermann Hospital / Houston Zoo, and Dryden / Texas Medical Center. The second of these stations is closest to the Allen Center and the South Colleges, yet the short distance from the edge of Lovett College to the station platform is anything but pedestrian-friendly. The student team will observe and identify hazards and elements that make this journey challenging across various times of day and weather conditions; study design solutions from other similar locations to improve the safety and desirability for pedestrians; and then develop an informed vision for this corridor between Lovett College and the light rail station accordingly.

8. **It Takes a Village.** An article appearing in the Houston Chronicle on December 3, 2014 announced that the Rice-owned 1990s era Village Arcade in the Rice Village would be "shedding" its "staid suburban-style shopping center" skin for a "hip, urban vibe [that] has a similar character to the shops around it." What if the pending Village Arcade renovation were to become a showcase for sustainable neighborhood-scale redevelopment?

   The project team should first carefully review the existing Village Arcade and identify what works and what does not as it exists today. The team should consider multiple perspectives: shoppers, employees, business owners, community members, potential customers (such as the thousands of adjacent Rice students), etc. while also paying particular attention to the building's envelope. Next, the team should review projects from elsewhere that represent successful transformations of suburban-style shopping centers, including those that are design updates to existing successful shopping centers and those that are true revivals of desolate or otherwise unsuccessful shopping centers. Finally, the team will develop a vision for the Village Arcade, one that is appropriate for the particular location and context, and one that represents a well thought-out sustainable design approach.

9. **Multiple Lenses, Multiple Perspectives.** While each project team is expected to bring multiple viewpoints to their work, this particular project asks the student team to choose their own Rice-focused design-oriented project (subject to instructor approval) and to explicitly represent the subject disciplines of each team member in framing the project, benchmarking, analyzing, and developing a solution or set of findings. For example, if the team consists of students from architecture, civil engineering, sociology, and kinesiology, then each of those disciplinary perspectives will be expected to be specifically and deeply represented (understanding of course that many

students are already by nature interdisciplinary thinkers!).

10. **Prefabrication: Fad or Future?** In late 2011, a team from Broad Sustainable Building constructed a 30-story hotel in just 15 days in Changsha, China (go watch the video!). Almost every part of the building was prefabricated off-site, then efficiently delivered and rapidly assembled on-site in the span of 360 hours. Prefabrication is not new to architecture. In 1968, the 21-story Hilton on the Riverwalk in San Antonio was constructed using elements of modularity in 202 days, with the bulk of the rooms (the modular part) assembled in 46 days. A century ago, Sears, Roebuck and Co. sold nearly 75,000 mail-order homes, with all the materials precut in a factory, ready for quick assembly. Yet by the time the Changsha hotel was completed on New Year's Eve in 2011, some felt that the design and construction industry had just witnessed its Sputnik moment – that its world would never be the same again.

    What opportunities does prefabrication offer to Rice University as a green design strategy? What are the trade-offs? What university building types or building components would potentially lend themselves to prefabrication? Why should (or shouldn't) the university pursue prefabricated solutions to its spatial needs, from a sustainability standpoint and otherwise? How is prefabrication being used at other universities, and why? Potential Rice-specific ideas to pursue an inquiry on prefabrication include:

    - A masters house
    - A second tower for Sid Richardson College
    - A low-rise (max 5 stories) residential college on the site to the north of Hanszen College (where Wiess College once stood) with commons, connected to the South Servery
    - An economical off-campus low-rise graduate student apartment complex (perhaps studied in comparison with the recently constructed Rice Village Apartments on Shakespeare Street)

11 **The Healthy Campus**. Some medical professionals are advocating for a shift in the provision of medical services from one focused on treating illnesses and diseases as they arise to a model focused on prevention. The design and operation of buildings can impact our health positively or negatively – for example, witness the many case studies of "sick building syndrome" on the one hand, and the studies documenting benefits of access to views and natural daylight on individual productivity and healing on the other. So where does one begin? The project team will review the existing literature and case studies and consult with experts to identify the common categories of design, operations, and actions that have the most

meaningful influence on the health of building occupants on a university campus (excluding laboratory spaces). The project team will then seek to identify typical Rice practices in these areas, and propose better alternatives if necessary. The key will be design and operational suggestions that prevent illness and promote wellness. The team could choose a common space type – like a restroom – to provide a more focused scope for the project.

12. **Sustainable Structured Parking?** As the Rice campus continues to grow westward, land once used or currently used for parking is being converted into new buildings and associated landscapes. In just a few years, the stadium parking lot is likely to look a lot different. Yet, those cars need to go somewhere. So how does a university committed to green building approach the design and construction of an above-ground and underground parking structure? The project team should think broadly and provide recommendations for each alternative, augmented with case studies and estimates (where possible) of environmental benefits. Policy changes are considered beyond the scope of this project.